

REMARKS

Claims 1-9 and 11-17 are pending in this application. Claims 1, 3, 5 and 8 have been amended herein to merely correct minor typographical errors. These amendments to claims 1, 3, 5 and 8 are not intended to narrow the scope of these claims in anyway.

Claim Rejections – 35 USC § 103

Claims 1-17 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Hausmann et al. (U.S. Patent No. 6,475,902), hereinafter “Hausmann,” in view of Lee et al. (U.S. Patent No. 5,665,659), hereinafter “Lee”. Applicants respectfully traverse this rejection for at least the following reasons.

Applicants note that claim 10 is rejected. However, claim 10 was previously canceled by Applicants in the Amendment filed October 31, 2003.

Claim 1 recites, *inter-alia*, “exposing said barrier conductor layer to a first gas atmosphere containing a reducing gas and free of plasma at an elevated substrate temperature.”

Claim 8 recites, *inter-alia*, “exposing said barrier conductor layer to an atmosphere of a reducing gas free from plasma at an elevated temperature.”

Claim 14 recites, *inter-alia*, “exposing said barrier conductor film to an atmosphere of a reducing gas free from plasma at an elevated temperature...”

By exposing the barrier conductor layer to a gas atmosphere containing a reducing gas and free of plasma at an elevated substrate temperature, adhesion between the barrier conductor layer and a metal film is improved.

The Examiner concedes that Hausmann does not disclose exposing the barrier layer to a first gas atmosphere containing a reducing gas and free of plasma at an elevated substrate temperature. The Examiner relies on Lee and contends that Lee discloses a method of fabricating a semiconductor device which includes exposing the barrier layer to a first gas atmosphere containing a reducing gas and free of plasma at an elevated substrate temperature and thus it would have been obvious to one of ordinary skill in the art to combine and modify the teachings of Hausmann and Lee by exposing the barrier layer to a first gas atmosphere containing a reducing gas and free of plasma at an elevated substrate temperature.

Lee simply discloses annealing a diffusion blocking layer under a nitride (N₂) atmosphere at high temperature between 450°C and 500°C while a small amount of oxygen is introduced to the N₂ atmosphere. The oxygen thus introduced forms an oxide layer on the

surface of the diffusion blocking layer. In Lee, the oxide layer is used to block the diffusion along the grain boundary layer.

Lee does not disclose or suggest exposing the barrier layer to a first gas atmosphere containing a reducing gas and free of plasma at an elevated substrate temperature. In fact, the incorporation of oxygen into the atmosphere of N₂ in Lee leads to the formation of an oxide at the grain boundary of the barrier metal film. The formation of an oxide film at the grain boundary of the barrier metal film leads to a poor adhesion between the barrier conductor layer and the metal film as well as an increase of electrical resistance between the barrier conductor and the metal film. This contrasts with the improved adhesion between the barrier conductor layer and the metal film achieved with the methods of claims 1, 8 and 14.

Therefore, one of ordinary skill in the art would not have been motivated to combine the teachings of Lee with the teachings of Hausmann.

Consequently, neither Hausmann nor Lee, alone or in combination, disclose, teach or suggest the subject matter recited in claims 1, 8 and 14.

Therefore, Applicants respectfully submit that claims 1, 8 and 14, and claims 2-7, 9, 11-13 and 15-17, are patentable. Thus, Applicants respectfully request that the rejection of claims 1-9 and 11-17 under § 103(a) be withdrawn.

CONCLUSION

In view of the foregoing, the claims are in form for allowance, and such action is hereby solicited. If any point remains in issue which the Examiner feels may be best resolved through a personal or telephone interview, please contact the undersigned at the telephone number listed below.

All objections and rejections having been addressed, it is respectfully submitted that the present application is in a condition for allowance and a Notice to that effect is earnestly solicited.

Respectfully submitted,

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